Post-Doctoral Position at Météo-France (CNRM)

Artificial Intelligence for Postprocessing Numerical Weather Prediction Systems in Urban Environments

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Position Details

Application Deadline	*8th November 2026*
Contract Duration	14.5 months
Starting Date	January 2027
Location	Toulouse, France
Department	Research in the VILLE team at CNRM, Météo-France

Context

In a context of **persistent urbanization** and **increasing heatwaves** linked to **climate change**, urban heat forecasting is becoming **increasingly critical** for society. However, **operational numerical models** like **AROME** (1.3 km resolution) and **ARPEGE** (5 km resolution) still lack the precision needed to accurately estimate urban temperatures. Additionally, **ARPEGE does not include an urban scheme**, which further limits its accuracy.

To reliably forecast urban temperatures, **hectometric-scale models** coupled with **urban climate models** and **state-of-the-art surface databases** are required. However, these models remain **computationally expensive** and present **major challenges** *(Lean et al., 2024)*.

AI-Based Solutions

To reduce costs, **Artificial Intelligence (AI) methods** have been developed to perform **downscaling** from AROME or ARPEGE to hectometric simulations *(Garcia Cristobal et al., 2026)*. However, these methods **do not eliminate existing biases** in hectometric models and downscaling **reproduces these biases** and using hectometric numerical models for training requires **expensive simulations**.

In recent years, **opportunistic data** (e.g., **NetAtmo**) have enabled the development of **hourly observed temperature maps** in urban areas at **~500 m resolution** *(Marques & Messier, 2025)* and could now be used as a reference dataset.

Objectives

Using an existing dedicated tool, the post-doctoral researcher will generate urban temperature fields from **NetAtmo station data** and using AI methods similar to those of *Garcia Cristobal et al. (2026)* will perform **hourly downscaling** from the **AROME or ARPEGE models** to these observed temperature fields.

A particular focus will be placed on the **construction of the cost function** for the statistical model, as well as on exploring **additional explanatory variables**, such as incorporating **previous or subsequent model forecast term** rather than just the one under study. Once the temperature fields are accurately emulated, the researcher could implement a **multivariate approach** to jointly forecast **temperature and humidity**.

These urban temperature forecast fields will then be evaluated in **test cities** with existing or past urban observation networks, such as **Dijon, Toulouse, or Rennes**. In addition to **classic metrics** like bias, RMSE, or super-quantiles, the evaluation will include **situation-specific metrics** to demonstrate the tool's added value, such as accurately forecasting **tropical nights** or **heatwave threshold exceedances**, and will be compared against the skills of AROME.

Ultimately, these urban temperature forecasts will enable **post-processing of AROME and ARPEGE outputs** to better anticipate **urban heat risks** in connection with **heatwave warnings**.

Required Skills

The ideal candidate must have:

- **PhD** in **atmospheric sciences, statistics, or AI**.
- **Strong background** in:
    - **Deep learning** (convolutional neural networks, geostatistics).
    - **Urban climate physics** (appreciated).
- **Technical skills**:
    - **Python** (TensorFlow, PyTorch).
    - **R**.
    - **Large-scale data processing**.
    - **Linux-based environments**.
- **Soft skills**:
    - **Scientific rigor** and **autonomy**.
    - **Written/oral communication in English**.
    - **Curiosity** and **analytical mindset**.

Practical Aspects

- **Work Location**: **National Centre for Meteorological Research (CNRM)**, **VILLE team**, Toulouse, France.
- **Collaboration**:
  - **COMPAS post-processing teams** (Météo-France).
  - **GMAP AI team** (CNRM).
- **Resources**:
  - Access to **Météo-France/CNRM computational facilities**.
  - Access to **Météo-France forecast datasets**.
  - Access to **Netatmo** datasets stored at Météo-France
- **Salary**:
  - **Raw monthly salary**: Depend on experience. *Between* 2940€ and 3403€ for a first post-doctoral contract.
  - Includes **French social security (health insurance)**.

Application Procedure

Interested candidates must send the following documents **by email** to:

- valery.masson@meteo.fr
- jean.wurtz@meteo.fr

Required Documents

1. **Curriculum Vitae (CV)**:
   - Detailed **experience** and **technical skills**.
1. **Motivation Letter**:
   - Explain your **interest in the position**.

References

Marquès, E., & Messier, K. P. (2025). Improved high resolution heat exposure assessment with personal weather stations and spatiotemporal Bayesian models. *GeoHealth*, *9*(9), e2025GH001451.

https://doi.org/10.1029/2025GH001451

Lean et al. (2024) : Lean, H. W., Theeuwes, N. E., Baldauf, M., Barkmeijer, J., Bessardon, G., Blunn, L., ... & Yang, X. (2024). The hectometric modelling challenge: Gaps in the current state of the art and ways forward towards the implementation of 100-m scale weather and climate models. *Quarterly Journal of the Royal Meteorological Society*, *150*(765), 4671-4708.

https://doi.org/10.1002/qj.4858

Garcia Cristobal et al. (2026) : Cristobal, J. G., Wurtz, J., Doury, A., Balogh, B., Masson, V., & Mestre, O. (2026). A Neural Network-based downscaling method for near surface temperature in urban areas. *Urban Climate*, *68*, 103076.

https://doi.org/10.1016/j.uclim.2026.103076